

# Glottoplasty for Male-to-Female Transsexualism: Voice Results

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**Summary: Objectives.** The aim of this study was to evaluate the objective voice results of Wendler's glottoplasty in male-to-female transsexuals.

**Method.** We retrospectively reviewed our patients treated with Wendler's technique with minor modifications. Glottoplasty consisted in CO<sub>2</sub>-laser epithelial ablation of the anterior commissure and the two vocal folds in anterior third, suturing of the two vocal folds with two stitches of 3.0 resorbable thread, and application of fibrin sealant to strengthen the suture. Voice assessment was based mainly on fundamental frequency ( $F_0$ ), frequency range, jitter, maximum phonation time, phonation quotient, estimated subglottic pressure (ESGP) grade of dysphonia ( $G$ ), and voice handicap index (VHI). These measures were taken before surgery and on the last follow-up visit.

**Results.** Our series included 15 patients with a mean age of 36 years. The mean follow-up period was 7.2 months. We did not observe any early complications related to the technique. The comparison between the preoperative and the postoperative measurements, using Wilcoxon signed rank test, showed a significant improvement of median  $F_0$  from 139 to 191 Hz ( $P = 0.006$ ) with an increase in the grade of dysphonia ( $G_{pre} = 0.2$ ,  $G_{post} = 1$ ,  $P = 0.013$ ) and ESGP ( $ESGP_{pre} = 8.1 \pm 3.2$ ,  $ESGP_{post} = 12.0 \pm 3.8$ ,  $P = 0.002$ ). Other measurements, including VHI, did not show any significant differences pre- and postoperatively.

**Conclusion.** Wendler's glottoplasty can contribute to feminize the voice.

**Key Words:** Transsexuals—Glottoplasty—Laser therapy—Voice analysis.

## INTRODUCTION

Although transsexualism is a recognized disorder of gender identity in which people believe themselves to be born into the "wrong" gender body,<sup>1</sup> it remains a very controversial topic.

The most frequent form (three out of four transsexuals) is male-to-female transsexualism (MFT).<sup>1</sup> MFT individuals undergo many cosmetic and reconstructive surgeries, medical and hormonal therapies, and behavioral changes before reaching the feminine status.

Before performing surgical changes, they must have been evaluated by a psychiatrist. Nearly all of them have undergone genital reassignment before seeking an ear, nose, and throat specialist's opinion.<sup>2</sup>

MFT individuals are stigmatized by their deep, male-sounding voices. Even when speech therapy is capable of feminizing the voice and vocal behavior by changing breathiness, intonation, articulation, word choice, and inflection, the male voice appears in uncontrolled situations, such as yawning, coughing, and laughing.<sup>2</sup> Their main desire is a naturally feminine voice rather than constant acting efforts to sound feminine.

Many surgical methods have been proposed for raising the pitch, using three fundamental principles: increasing the vocal folds' tension, altering the vocal folds' consistency, and decreasing the vocal folds' mass. The most frequently used method is cricothyroid approximation (CTA), first described by Isshikki et al;<sup>3</sup> however, its main drawbacks are external incision, majoration of the thyroid notch, and inconsistent long-term results. Wendler in 1989<sup>4</sup> described an endoscopic technique that has the advantage of the absence of cervical incision and more stable long-term results.<sup>2</sup> However, his findings have not been verified by other teams, and there are not many submissions on this topic in the English literature. Finally, peer-reviewed publications are very limited on this topic.<sup>1,5</sup>

Our aim is to report our series of 15 consecutive patients who underwent voice feminization using a modified Wendler's technique emphasizing on objective voice results.

## MATERIALS AND METHODS

We retrospectively reviewed the records of all consecutive patients treated in our department between August 2006 and August 2008. All surgeries were performed by the senior author using Wendler's technique with minor modifications.

### Surgical procedure

The procedure was performed under general anesthesia, with jet ventilation and as an outpatient surgery. The endolarynx was exposed via direct laryngoscopy. The anterior part of the vocal folds was deepithelized using the CO<sub>2</sub> laser with Acublade system (Lumenis, Santa Clara, CA) with a 10-W intensity, continuous mode, and a 2-mm beam. The free edge and the superior and inferior surfaces of the vocal folds are deepithelized. Care is taken not to injure the vocal ligament. The

Accepted for publication July 8, 2009.

Financial support and funding: the authors did not receive any financial support for the writing of this article. The manuscript is not simultaneously submitted elsewhere and has not been previously published.

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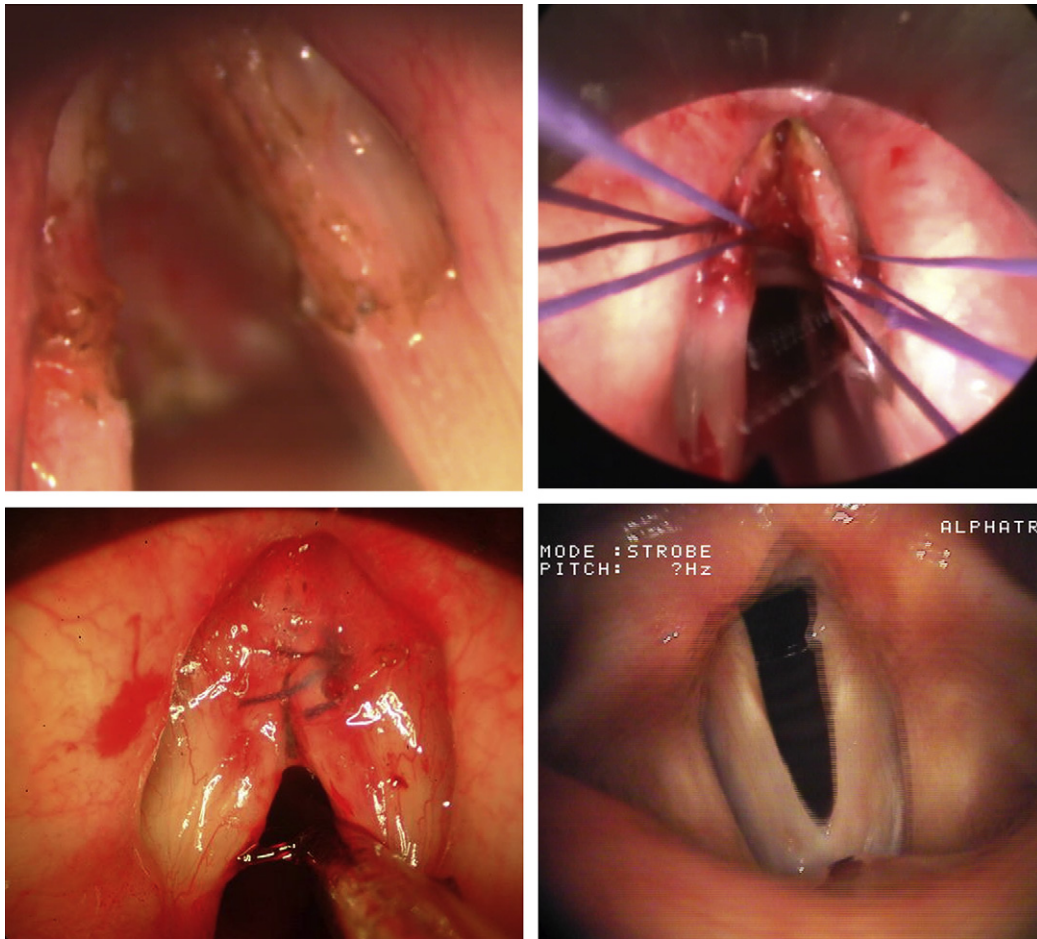
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Journal of Voice, Vol. 25, No. 1, pp. 120-123

0892-1997/\$36.00

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doi:10.1016/j.jvoice.2009.07.004



**FIGURE 1.** Steps in Wendler's glottoplasty.

corresponding tissue of the vocal folds is firmly sutured to obtain a V shaped anterior commissure. We used a laparoscopic forceps to maintain the needle and a knot pusher (Ethicon, NJ, United States) to secure the suture. Four 3.0 resorbable threads, two for each vocal fold, are needed. One thread is passed through the vocal ligament at the junction between the anterior and the middle third. The second is passed more anteriorly to the first. The same procedure is performed on the contralateral fold. The anterior thread is ligated together through one knot, inferior to the glottis plan and one knot superior to the glottic plane. The same procedure is performed for the more posterior two threads. At the end of the procedure, fibrin sealant was used to strengthen the suture (Figure 1A–D).

A 10-day complete vocal rest period is necessary. This vocal rest period is empirical, but is meant to limit tension forces to prevent the dehiscence of suture points. Patients are treated with antibiotics (amoxicilline + clavulanic acid: 1 g three times daily) for 1 week, double-dose proton pump inhibitors for 6 weeks, and inhaled steroids twice daily for 1 week.

### Voice assessment

Voice assessment was based mainly on fundamental frequency ( $F_0$ ), frequency range, jitter, maximum phonation time (MPT),

phonation quotient (PQ), estimated subglottic pressure (ESGP) grade (G), and voice handicap index (VHI). The VHI was self-completed by the patient.

For the perceptual analysis, we used the grade of dysphonia according to the grader, roughness, asthenia, breathiness, strain (GRABS) Hirano scale, which is most frequently used for subjective voice analysis in daily practice. The assessment was performed by the speech pathologist. Objective voice measurements were made at the first follow-up visit, at 2 months after the surgery, then at 6 months, and at 2 years. We report the results of the presurgical and last follow-up visit. Statistical analysis of the previously mentioned voice parameters was performed using Wilcoxon signed rank test, because of the small number of patients and the non-normal distribution of the variables. Results were considered statistically significant when  $P$  value was less than 0.05. They are expressed as median with a 95% confidence interval (CI).

The study received the approval of the ethics committee of the Université Catholique de Louvain.

### RESULTS

Our series includes 15 patients with a mean age of 42.5 years. The ages ranged between 22 and 57 years.

**TABLE 1.**  
**Pre- and Postoperative Voice Parameters Compared**  
**With Other Results in the Literature**

Voice Parameters	Our Series	Gross <sup>2</sup>	Orloff et al <sup>5</sup>
Preoperative fundamental frequency (Hz)	150	116.8	142
Postoperative fundamental frequency (Hz)	194	201.0	168
Preoperative frequency range	438 Hz	32.8 semitones	
Postoperative frequency range	241 Hz	23.3 semitones	

Most of them did have speech therapy before the intervention. All of them started speech therapy after the vocal rest period of 10 days. The mean follow-up period was 7.2 months, ranging between 2 and 39 months. We did not observe any early complications related to the technique. The comparison between the preoperative and the last postoperative measurements shows a significant improvement of median  $F_0$  from 150 Hz (CI = 118–182) to 194 Hz (CI = 146–242), with  $P = 0.006$ . The mean frequency range had a tendency to decrease after the surgery with preoperative mean range of 438 Hz (CI = 258–618), postoperative mean range of 241 Hz (CI = 102–380), with  $P = 0.084$ .

The grade of dysphonia according to Hirano scale was significantly worse postoperatively ( $G_{\text{pre}} = 0.2$ ,  $G_{\text{post}} = 1$ ,  $P = 0.013$ ). The jitter increased with a mean preoperative value of 1.4% (CI = 0.6–3.2) and a mean postoperative value 2.7% (CI = 0.5–4.9) with  $P = 0.012$ . The VHI score was stable with preoperative values at 45.5 and postoperative value at 42 ( $P = 0.47$ ).

Mean MPT did not change significantly ( $\text{MPT}_{\text{pre}} = 17.5$  seconds,  $\text{MPT}_{\text{post}} = 18.3$  seconds,  $P = 0.72$ ). The PQ was stable:  $\text{PQ}_{\text{pre}} = 263$  mL/s and  $\text{PQ}_{\text{post}} = 377$  mL/s,  $P = 0.51$ . Estimated subglottic pressure (Hp) was significantly higher ( $\text{ESGP}_{\text{pre}} = 8.1 \pm 3.2$ ,  $\text{ESGP}_{\text{post}} = 12.0 \pm 3.8$ ,  $P = 0.002$ ). Our pre- and postoperative data compared with other literature results are listed in Table 1.

## DISCUSSION

Voice change remains an important problem in transsexuals. Many options have been provided to feminize the voice. Some authors rely on voice therapy and others on surgical procedures.

Voice therapy has the advantages of being noninvasive and working on the pitch and overall vocal behavior. However, patients are often dissatisfied with speech therapy alone.

Surgeries are numerous with pros and cons for each technique. CTA first described by Isshikki et al,<sup>3</sup> then modified by Lee et al<sup>6</sup> followed by Sataloff,<sup>7</sup> is the most commonly used method. It commonly produces good early results followed by pitch decline within 6–18 months. Anterior commissure advancement introduced by LeJeune et al<sup>8</sup> and modified by Tucker<sup>9</sup> has the disadvantages of the external approach and

additional accentuation of the thyroid prominence. Although some series are reported in the literature with good results, the number of patients in each series is small.

Wagner et al<sup>10</sup> report 14 MFT individuals who underwent anterior commissure advancement, CTA, or both, after inadequate improvements after speech therapy alone. Results were evaluated subjectively and objectively. Median follow-up was 6.5 months. Subjective success rates were 78.5% and 71.5% according to the patients and speech therapists, respectively. Usual, maximal, and minimal frequencies increased significantly. Median postoperative gain in usual fundamental frequency was 11 Hz.

In the laser-assisted voice adjustment technique described by Orloff et al<sup>5</sup> on 31 MFT individuals with androphonia, many of them with previous phonosurgery or speech therapy at other centers, pitch increased by a mean of 26 Hz. Self-evaluations revealed increases in voice femininity, congruity with self-image, and satisfaction. However, the evaluations also showed decreased vocal quality, loudness, and vocal range probably because of the vaporization technique performed 1–2 mm lateral to the free edge of the vocal fold extending along the superior surface of the vocal fold from the vocal process to as far anterior as possible.

Wendler's technique relies on deepithelialization of only the anterior third of the vocal folds and suture in a V shape; thus, the vocal folds are shortened, and the vibrating mass of the vocal folds is reduced. Using this technique in 10 transsexuals (age between 30 and 57 years), Gross<sup>2</sup> reported reduced voice range for the lower frequencies, and an increase of the habitual frequency (mean<sub>pre</sub> = 116.8 Hz, mean<sub>post</sub> = 201.0 Hz) with a follow-up ranging between 35 and 45 months.

Our series has the advantage of reporting results on patients who did not undergo previous surgeries and provide data on voice parameters not often evoked in the literature. The drawbacks are that it includes primary and secondary transsexuals and the follow-up period is not similar for all patients.

In our patients, the mean  $F_0$  was improved significantly with a decrease in voice range. Results are concordant with those of Gross. Three patients had degradation of their  $F_0$ , were patients older than 45 years (secondary transsexualism), and two of them continued to smoke. Subjectively, the patients did not notice an improvement using the VHI, and the therapist noticed an aggravation of the grade of dysphonia probably because of the more important vocal effort.

The VHI did not improve, probably because it was not sensitive enough and because of the often very high expectations of the patients. Although they recognize the change in pitch and are happy that they are recognized females on the phone, it does not correspond to their expected model that most of the time corresponds to a female artist with a fundamental frequency higher than the mean female fundamental frequency (200–215 Hz). Subglottic pressure is augmented because of the more important work to perform after reduction of the surface of the glottic aperture; however, the vocal effort tends to decrease with time. As most of the patients are young and not vocal performers, they are not bothered by the temporary rise of vocal effort and the decrease in vocal range. The technique

does not resolve all the problems of voice feminization but is minimally invasive with stable results in time regarding increased fundamental frequency.

## CONCLUSION

Laryngeal surgery is only a part of voice feminization in transsexuals. Wendler's glottoplasty can contribute to feminize the voice. Special care should be taken not to deepithelize more than anterior third of the vocal folds. Further improvements in  $F_0$  will probably be seen in series including only primary transsexuals. Speech therapy must be added to modify the vocal behavior. Counseling is very important to verify that patients have realistic expectations.

## Acknowledgment

The authors would like to thank Dr. Jamart for the statistical work and Mr. Rustom for the translation of the manuscript.

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